NON-PUBLIC?: N
ACCESSION #: 9
09120339
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Limerick Generating Station, Unit 2 PAGE: 1 OF 6

DOCKET NUMBER: 05000353

TITLE: Reactor Scram due to a High Reactor Vessel Water Level
Main Turbine Trip Caused by a Momentary Loss of Power to
the Feedwater Control System.
EVENT DATE: 08/08/95 LER #: 95-008-00 REPORT DATE: 09/07/95

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
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Assessment, LGS

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On August 8, 1995, at approximately 1337 hours, Unit 2 was operating at 100% power when an automatic reactor scram occurred. The scram resulted when the main turbine tripped on high reactor pressure vessel water level of +54 inches instrument level. Prior to the main turbine trip, a 2A reactor feed pump lockout, 2A & 2B reactor recirculation pump runback to the low speed limit, and a swap of the feedwater level control system (FWLCS) master level controller and 2A/2B/2C RFP motor gear units from Auto to Manual control occurred. The reactor operator attempted to take manual control of the FWLCS, but was unable to prevent the level transient. Detailed troubleshooting identified that the "A" FWLCS power supply experienced a momentary loss of output power for approximately 250 milliseconds which caused the aforementioned equipment responses. All

plant systems responded properly to the transient. The cause is believed to be a loose connection in the DC output of the FWLCS power supply. A detailed check of all terminal connections was performed.

END OF ABSTRACT

Unit Conditions Prior to the Event

Unit 2 was in Operational Condition (OPCON) 1 (Power Operation) at 100% power level.

Description of the Event

On August 8, 1995, at approximately 1336 hours, Unit 2 Reactor Protection System (RPS, EIIS:JC) actuation (i.e., a reactor scram) occurred. All control rods (EIIS:ROD) inserted as required. The RPS actuation resulted when the Unit 2 main turbine (EIIS:TRB) tripped on high reactor pressure vessel (RPV, EIIS:RPV) water level at +54 inches instrument level.

Prior to the main turbine trip, a 2A Reactor Feed Pump (RFP, EIIS:SJ, P) signal failure lockout occurred, both the 2A & 2B reactor recirculation pumps (RRPs, EIIS:AD, P) ran back to their low speed settings, and the Feedwater Level Control System (FWLCS, EIIS:JB) Master Level Controller (MLC, EIIS:LC) and the individual 2A, 2B, and 2C RFP Motor Gear Units (MGUs, EIIS:SC) swapped from automatic to manual control. The combined effect of these events caused the RPV water level to swell. The Reactor Operator (RO) attempted to manually reduce feedwater flow; however, RPV water level reached +54 inches causing a main turbine trip as well as tripping the 2A, 2B, and 2C RFPs. In addition, the High Pressure Coolant Injection (HPCI, EIIS:BJ) and the Reactor Core Isolation Cooling (RCIC, EIIS:BN) systems also received a trip signal due to the high RPV water level. The RPS actuation occurred approximately 40 seconds into the RPV water level transient. The main turbine trip subsequently resulted in the tripping of both the 2A and 2B RRPs.

Approximately three seconds following the main turbine trip, a subsequent reactor scram signal was generated on high RPV pressure of 1096 psig.

Approximately six seconds following the main turbine trip, an additional reactor scram signal was generated on RPV water level below +12.5 inches instrument level due to the RFP trips, and a Group IIB Primary Containment and Reactor Vessel Isolation Control System (PCRVICS, EIIS:JM), an Engineered Safety Feature (ESF), isolation signal was generated. The isolation valves (EIIS:ISV) were already closed, i.e., in their post accident safety function position.

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Therefore, no valve movement occurred in response to the signal. Group IIB of PCRVICS involves the Residual Heat Removal (RHR, EIIS:BO) heat exchanger sample lines (EIIS:SMV) and RHR drain lines to radwaste. Also at this time, in accordance with Transient Response Implementation Plan (TRIP) procedure T-100, "Scram," the RO placed the mode switch in the shutdown position.

The minimum RPV water level observed was -33 inches instrument level. Operations entered TRIP procedure T-101, "Reactor Pressure Vessel Control," returned the 2A RFP to service and restored RPV water level to greater than +12.5 inches with the FWLCS in the single element, startup level control mode.

A four hour notification was made to the NRC at 1550 hours on August 8, 1995, in accordance with the requirements of 10CFR50.72(b)(2)(11) since this event involved automatic RPS and ESF actuations. This report is submitted in accordance with the requirements of 10CFR50.73(a)(2)(iv).

Analysis of the Event

A main turbine trip from high power is the most severe transient that the plant is anticipated to undergo, and the plant responded as designed. The main turbine and the three RFPs tripped due to the high RPV water level. Had the main turbine and the RFPs failed to trip on the high RPV water level, by procedure, the operators would have taken the necessary manual actions to ensure that the turbines tripped.

The reactor scrammed as a result of the main turbine trip due to turbine stop valve closure. All control rods properly inserted in response to the scram signal. Had the reactor scram failed to occur as a result of the turbine stop valve closure trip signal, the reactor would have scrammed due to the various other automatic scram signals generated during the event, or due to the manual scram signal generated by the RO taking the mode switch to the shutdown position.

The maximum reactor pressure observed in response to the turbine trip was 1096 psig. This pressure is well below the Technical Specifications (TS) Safety Limit of 1325 psig as measured in the reactor steam dome. All 14 main steam relief valves (EIIS:RV) were operable and would have lifted as necessary to maintain reactor pressure below the Safety Limit.

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Subsequent investigation revealed that the initiator of the level transient was a momentary loss of power from the "A" FWLCS power supply, E/S-XX-2K612 (EIIS:EI, JX). This power supply feeds the MLC and the A/B/C MGU logic cards, the 2A RFP control logic, and the RRP runback logic as well as several alarms cards. The 2A RFP lockout, the RRP runbacks, and the swapping from automatic to manual of the MLC and RFP MGUs were all appropriate responses to the loss of power from the 2K612 power supply.

Although the 2A and 2B RRPs initially ran back to their low speed settings due to the momentary loss of power to the run back logic, the pumps subsequently tripped as designed in response to an end-of-cycle recirculation pump trip (EOC-RPT) due to the turbine trip greater than 30% power.

The Group IIB PCRVICS isolation signal was generated as designed when reactor water level went below the low reactor water level isolation actuation setpoint. There was no impact due to this isolation signal since the Group IIB isolation valves were already in their normally closed position, which is also their post accident safety function position. The Group IIB isolation signal was subsequently reset. No other ESF actuations occurred during this event.

The operating crew took immediate actions to control feedwater and promptly entered TRIP procedure T-101 following the reactor scram. The plant was quickly stabilized and RPV water level was restored to greater than +12.5 inches instrument level. There were no Emergency Core Cooling System (ECCS) or Emergency Diesel Generator (EDG) starts during this event.

Cause of the Event

The Unit 2 reactor scram was caused by a main turbine trip due to high RPV water level at +54 inches. The level transient was caused by a momentary loss of DC power to the instrument loads supplied from the 2K612 power supply. A total of 14 computer points from cards and transmitters supplied from the 2K612 power supply showed a "Loss-of-Signal" to the computer for approximately 250 milliseconds at the initiating time of the transient. A total of 12 computer points associated with FWLCS powered from other power supplies (i.e., 2K611, 2K613) showed normal response for the transient.

The original power supply was replaced. Extensive testing was performed to verify the condition of the power supply. Visual inspection, AC ripple and DC voltage checks under varying load conditions were performed. This testing demonstrated the original power supply to be in good functional condition.

Additionally, large load step changes indicate that if the power supply output had been shorted (about 15 amps for 1.75 seconds) by a load short circuit, then the AC input fuse to the power supply would have opened. For testing purposes, a slow blow fuse was used and the power supply demonstrated the ability to supply over 19 amps for greater than 8 seconds.

The actual in-plant AC input fuse (EIIS:FU) was replaced. The original fuse was the correct rating and analysis indicates the fuse was in good condition. Because the actual in-plant fuse for the AC input to 2K612 was not blown, then the power supply did not receive a load short circuit condition. In addition, all 2K612 power supply load, were verified to be functioning normally by checking card output voltages and signal indications. This confirms that there was no output short circuit on the power supply.

Testing of the E/S-XX-218 Uninterruptible Power Supply (EIIS:UPX) (i.e., AC power supply to the 2K612 power supply) showed the UPS to be functioning normally. The UPS was monitored under normal load conditions. The internal diagnostic checks showed operating characteristics to be normal with expected values.

All current carrying connections in the 218 UPS input to the 2K612 power supply and from the 2K612 power supply output to various loads were checked. All connections were found tight with no abnormal indications of overheating, wear, or fraying. However, extensive postscram troubleshooting had been performed in the 2C612 instrument panel prior to all of the connections being checked.

Based on the results of the testing and analyses performed as described above, the most probable cause of the momentary loss of power was a loose connection on the DC output of 2K612 power supply which was unknowingly corrected during post-scram troubleshooting efforts.

Corrective Actions

The 2K612 FWLCS power supply was replaced with pre- and post- - installation checks performed on the new supply. In addition, the 120 VAC electrical supply fuse to the 2K612 FWLCS power supply was replaced.

A detailed check of all terminal connections was performed in the 2C612 instrument panel with no problems identified. Additionally, the "A" FWLCS UPS connections were checked and the UPS was verified to be functioning properly.

A recorder was placed in the 2C612 instrument panel to monitor the +24 VDC output from the 2K612 power supply. The recorder will be removed following management review of acceptable power supply performance for at least six months.

A detailed restoration plan was developed and implemented prior to exceeding 450 psig during Unit 2 plant startup on August 11, 1995, to ensure proper operation of the FWLCS.

Previous Similar Occurrence

None

ATTACHMENT TO 9509120339 PAGE 1 OF 1

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10CFR50.73

September 7, 1995

Docket No. 50-353

License No. NPF-85

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Licensee Event Report
Limerick Generating Station - Unit 2

This LER reports an automatic actuation of the Unit 2 Reactor Protection System resulting from a main turbine trip on reactor vessel high water level. The level transient was caused by a momentary loss of power from the Feedwater Level Control System power supply.

Reference: Docket No. 50-353
Report Number: 2-95-008
Revision Number: 00
Event Date: August 8, 1995
Report Date: September 7, 1995
Facility: Limerick Generating Station
P.O. Box 2300, Sanatoga, PA 19464-
2300

This LER is being submitted pursuant to the requirements of 10CFR50.73(a)(2)(iv).

Very truly yours,

GHS

cc: T. T. Martin, Administrator Region I, USNRC
N. S. Perry, USNRC Senior Resident Inspector, LGS

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